

REMARKS/DISCUSSION OF ISSUES

By this Amendment, Applicants amend the Title and amend claims 1-13 for clarification. Accordingly, claims 1-13 are pending in the application.

Reexamination and reconsideration are respectfully requested in view of the following Remarks.

OBJECTION TO TITLE

The Office Action objects to the Title as not being sufficiently descriptive.

By this Amendment Applicants amend the Title to be more descriptive.

Accordingly, Applicants respectfully request that the objection to the Title be withdrawn.

35 U.S.C. §§ 102 & 103

The Office Action rejects: claims 1, 3, 4 and 6-10 under 35 U.S.C. § 102 over Bertrum et al. U.S. patent application publication 2003/0042850 (“Bertrum”); claims 2 and 11-13 under 35 U.S.C. § 103 over Bertrum in view of Bulovic et al. U.S. patent application publication 2004/0023010 (“Bulovic”); and claim 5 under 35 U.S.C. § 103 over Bertrum in view of Lin et al. U.S. patent application publication 2003/0099860 (“Lin”)

Applicants respectfully traverse these rejections for at least the following reasons.

Claim 1

Among other things, the method of claim 1 includes: (1) generating in electroluminescent organic molecules of an organic matrix excited states in the form of excitons in response to supplied electrons and hole; and (2) transferring excitons from the electroluminescent organic molecules to the transfer molecules on the quantum dots.

Applicants respectfully submit that Bertrum does not disclose any method including this combination of features.

The Office Action cites paragraphs [0006]-[0009], [0023], [0025] and [0029] as

all supposedly disclosing these features.

Applicants respectfully disagree.

Applicants respectfully submit that the cited text does not disclose any electroluminescent organic molecules of an organic matrix that produce excitrons from supplied electrons and holes and transfer those excitons to the transfer molecules on the quantum dots. Applicants respectfully submit that Bertrum does not disclose in the cited text or anywhere else that any electroluminescent organic molecules of an organic matrix produce excitrons from supplied electrons and holes. Indeed, Applicants respectfully submit that Bertrum does not even disclose that its quantum dots are embedded in any organic matrix of electroluminescent organic molecules. Bertrum only discloses that its quantum dots are embedded in a matrix that may be an organic material such as polyimide, or an inorganic material like zinc sulfide. It is to be noted that Bertrum describes in paragraph [0003] a prior art electroluminescent device which uses electroluminescent polymers such as PPVs, but nowhere does Bertrum disclose or suggest that these prior art devices include any quantum dots, and particularly any quantum dots embedded in an organic matrix of electroluminescent organic molecules.

Instead of a device operating according to the method of claim 1, Applicants respectfully submit that Bertrum discloses a device where electrons or holes or electron-hole pairs are supplied directly to the capping molecules from the layers 2 and 4, as described in Applicants' specification on page 2, lines 23-27.

Therefore, for at least these reasons, Applicants respectfully submit that claim 1 is patentable over Bertrum. Accordingly, Applicants respectfully request that the rejection of claim 1 be withdrawn, and claim 1 be allowed.

Claims 3, 4 and 6-7

Claims 3, 4 and 6-7 depend from claim 1 and are deemed patentable for at least the reasons set forth above with respect to claim 1, and for the following additional reasons.

Claim 4

Among other things, the method of claim 4 includes providing transfer molecules which have a bandgap, E_{transfer} , which is smaller than a bandgap, $E_{\text{org. mol.}}$, of the electroluminescent organic molecules and larger than a bandgap, E_{QD} , of the quantum dots.

As discussed above, Bertrum does not disclose any arrangement that includes a combination of quantum dots embedded in electroluminescent organic molecules, and therefore also cannot disclose an arrangement where transfer molecules have a bandgap, E_{transfer} , which is smaller than a bandgap, $E_{\text{org. mol.}}$, of electroluminescent organic molecules and larger than a bandgap, E_{QD} , of quantum dots.

Therefore, for at least these additional reasons, Applicants respectfully submit that claim 4 is patentable over Bertrum.

Claim 6

Among other things, in the method of claim 6 a transfer rate of excitons from electroluminescent organic molecules to transfer molecules is larger than a decay rate of excitons in the electroluminescent organic molecules.

As discussed above, Bertrum does not disclose any single device that includes a combination of quantum dots having transfer molecules on their surfaces embedded in electroluminescent organic molecules, and therefore also cannot disclose an arrangement where a transfer rate of excitons from electroluminescent organic molecules to transfer molecules is larger than a decay rate of excitons in the electroluminescent organic molecules.

Therefore, for at least these additional reasons, Applicants respectfully submit that claim 6 is patentable over Bertrum.

Accordingly, Applicants respectfully request that the rejections of claims 3, 4 and 6-7 be withdrawn, and claims 3, 4 and 6-7 be allowed.

Claim 8

Among other things, the device of claim 8 includes an organic matrix of electroluminescent organic molecules embedded with quantum dots, wherein a quantum dot has one or more transfer molecules attached to its surface for receiving

excitons generated in the electroluminescent organic molecules and transferring received excitons to the quantum dot.

For similar reasons to those set forth above with respect to claim 1, Applicants respectfully submit that Bertrum does not disclose any device including this combination of features.

Also among other things, in the device of claim 8 a transfer rate of excitons from the electroluminescent organic molecules to the transfer molecules is larger than a decay rate of excitons in the electroluminescent organic molecules.

The Office Action makes no mention of this feature. Instead, the Office Action states that “*claim 8 recites essentially the same limitations as of claim 1.*” However, claim 1 does not recite that a transfer rate of excitons from the electroluminescent organic molecules to the transfer molecules is larger than a decay rate of excitons in the electroluminescent organic molecules. So claim 8 could not be rejected for the same reasons as claim 1. Furthermore, Applicants respectfully submit that Bertrum does not disclose any single device that includes a combination of quantum dots having transfer molecules on their surfaces embedded in electroluminescent organic molecules, and therefore also cannot disclose an arrangement where a transfer rate of excitons from electroluminescent organic molecules to transfer molecules is larger than a decay rate of excitons in the electroluminescent organic molecules.

Therefore, for at least these reasons, Applicants respectfully submit that claim 8 is patentable over Bertrum. Accordingly, Applicants respectfully request that the rejection of claim 8 be withdrawn, and claim 8 be allowed.

Claims 9-10

Claims 9-10 depend from claim 8 and are deemed patentable for at least the reasons set forth above with respect to claim 8. Accordingly, Applicants respectfully request that the rejections of claims 9-10 be withdrawn, and claims 9-10 be allowed.

Claim 11

At the outset, Applicants rely upon at least the following standards with respect to a proper rejection under 35 U.S.C. § 103.

First, a rejection on obviousness grounds under 35 U.S.C. § 103 cannot be

sustained by mere conclusory statements: instead there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. In re Kahn, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006). See also KSR International Co. v. Teleflex Inc., 550 U.S. 398, 82 USPQ2d 1385, 1396 (2007) (quoting Federal Circuit statement with approval). See M.P.E.P. § 2141(III). Second, there must be a reasonable expectation of success. “*The mere fact that references can be combined or modified does not render the resultant combination obvious unless the results would have been predictable to one of ordinary skill in the art.*” M.P.E.P. § 2143.01(III) (citing KSR International Co. v. Teleflex Inc., 82 USPQ2d 1385, 1396 (2007)). Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. “*All words in a claim must be considered in judging the patentability of that claim against the prior art.*” M.P.E.P. § 2143.03 (citing In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970)). An integral part of this analysis requires establishing the level of ordinary skill in the art of invention. See M.P.E.P. §§ 2141(II)(C) and 2141.03.

Among other things, the method of claim 11 includes providing a solution comprising a plurality of quantum dots with one or more transfer molecules attached to the surfaces, the transfer molecules having a bandgap, E_{transfer} , which is smaller than a bandgap, $E_{\text{org. mol.}}$, of the electroluminescent organic molecules and larger than a bandgap, E_{QD} , of the quantum dots, mixing the electroluminescent organic molecule solution with the quantum dot solution, and forming a matrix of electroluminescent organic molecules with embedded quantum dots.

Applicants respectfully submit that the prior art does not disclose or suggest any method that includes this combination of features.

The Office Action states that “*Bertrum and Bulovic disclose*” a method including these features.

Respectfully, there is a Bertrum reference, and there is a Bulovic reference, but there is no “*Bertrum and Bulovic*” reference. The Office Action fails to explain with respect to claim 11 how the various teachings of Bertrum are supposed to be

combined with the teachings of Bulovic to produce the method of claim 11. Indeed, the Office Action does not even explain where it proposes to find the various elements of claim 11 in the cited references. The Office Action fails to provide any articulated reasoning with some rational underpinning to support the combination of references with respect to claim 11 or to support any conclusion of obviousness. Instead, the Office Action offers a mere conclusory statement. Indeed, the Office Action fails to even establish the level of ordinary skill in the art of invention of claim 11.

Meanwhile, Applicants respectfully submit that no combination of Bertrum and Bulovic could ever produce the method of claim 11. In particular, Applicants respectfully submit that there is nothing in Bertrum and Bulovic that would have provided a reason for one of ordinary skill in the art at the time of the invention to have provided a plurality of electroluminescent organic molecules in solution, provided a solution comprising a plurality of quantum dots with one or more transfer molecules attached to the surfaces, the transfer molecules having a bandgap, E_{transfer} , which is smaller than a bandgap, $E_{\text{org. mol.}}$, of the electroluminescent organic molecules and larger than a bandgap, E_{QD} , of the quantum dots, and mixed the electroluminescent organic molecule solution with the quantum dot solution. Indeed, Applicants respectfully submit that none of the references teach any arrangement which includes a combination of electroluminescent organic molecules and quantum dots with one or more transfer molecules attached to the surfaces.

Therefore, for at least these reasons, Applicants respectfully submit that claim 11 is patentable over the cited art. Accordingly, Applicants respectfully request that the rejection of claim 11 be withdrawn, and claim 11 be allowed.

Claims 12-13

Claims 12-13 depend from claim 11 and are deemed patentable for at least the reasons set forth above with respect to claim 11. Accordingly, Applicants respectfully request that the rejections of claims 12-13 be withdrawn, and claims 12-13 be allowed.

Claims 2 and 5

Claims 2 and 5 depend from claim 1. Applicants respectfully submit that neither Bulovic nor Lin remedies the deficiencies of Bertrum as set forth above with respect to claim 1. Therefore, claims 2 and 5 are deemed patentable for at least the reasons set forth above with respect to claim 1, and for the following additional reasons.

Claim 2

Applicants respectfully traverse the proposed combination of Bertrum and Bulovic with respect to claim 2 for at least the following reasons.

The Office Action fairly admits that Bertrum does not disclose “*preparing the matrix*” from a solution of organic molecules and quantum dots.

At the outset, Applicants note that claim 2 recites providing an organic matrix of electroluminescent organic molecules with embedded quantum dots by preparing the organic matrix from a solution of electroluminescent organic molecules and quantum dots.

The Office Action then states that Bulovic teaches dispersing quantum dots in a solution of organic molecules (TPD) and thus forming a matrix of organic molecules embedded with quantum dots, and that modifying Bertrum to include this feature would reduce the number of pinhole shorts in the emissive layer.

However, Applicants respectfully submit that at most this would provide a reason to modify Bertrum to disperse quantum dots in a solution of organic molecules to form the organic matrix that Bertrum teaches in paragraph [0029], but since Bertrum does not teach providing any organic matrix of electroluminescent organic molecules that include quantum dots, this would not provide any reason to modify Bertrum to provide an organic matrix of electroluminescent organic molecules with embedded quantum dots by preparing the organic matrix from a solution of electroluminescent organic molecules and quantum dots.

Therefore, for at least these reasons, Applicants respectfully submit that claims 2 and 5 are patentable over the cited art. Accordingly, Applicants respectfully request that the rejection of claims 2 and 5 be withdrawn, and claims 2 and 5 be

allowed.

CONCLUSION

In view of the foregoing explanations, Applicants respectfully request that the Examiner reconsider and reexamine the present application, allow claims 1-13 and pass the application to issue. In the event that there are any outstanding matters remaining in the present application, the Examiner is invited to contact Kenneth D. Springer (Reg. No. 39,843) at (571) 283.0720 to discuss these matters.

Respectfully submitted,

VOLENTINE & WHITT



By:

Kenneth D. Springer
Registration No. 39,843

VOLENTINE & WHITT
One Freedom Square
11951 Freedom Drive, Suite 1260
Reston, Virginia 20190
Telephone No.: (571) 283.0724
Facsimile No.: (571) 283.0740